Novel Heat Flow Probe Design and Deployment, Phase I

Completed Technology Project (2009 - 2009)

Project Introduction

We propose to develop a novel method for deploying heat flow sensors/heaters in a hole and also a novel approach to subsurface access using a percussive method. The sensor deployment concept consists of a deployable string of thermal sensors/heaters initially housed inside a hollow probe. As envisioned, the deployable sensor string would consist of thermal sensors/heaters mounted to small spring-like structures of low thermal inertia fastened to a tether at appropriate intervals. The probe assembly is driven into the subsurface using a percussive (high frequency low impact) actuator. Upon reaching depth, the cone mounted at the end of the tube would separate from penetrometer and left behind as an anchor for the sensor string. The sensor string would then be deployed from the tube as the tube is retracted from the hole. The proposed method offers many advantages including: Optimum thermal isolation between consecutive heat flow sensors (RTD`s) Thermal isolation between sensors and a lander platform/deployment system, Direct contact between the sensors and regolith, Percussive deployment method that does not rely extensively on lander mass All the electrical connectors will be established prior to the launch

Anticipated Benefits

Potential NASA Commercial Applications: Non-NASA applications include measuring of heat flow in areas on earth, where optimal thermal isolation of heaters/temperature sensors is of paramount importance. These for example include areas with hydrocarbon potential. Therefore exploration companies, such as Shell or Chevron, would in particular be interested in this technology. Since these heat probes are small and can be made relatively cheaply, they can be left in earth forever. Thus, the heat flow data can be accumulated all the time. This in particular would be important for tracking global climate change and to understand the nature and causes of climate change. Thus, proposed heat flow deployment method, because of potential cost savings, may allow more heat flow probes being deployed around the earth. The possible 'customer' may for example be the International Heat Flow Commission of IASPEI, who initiated the project "Global Database of Borehole Temperatures and Climate Reconstructions".

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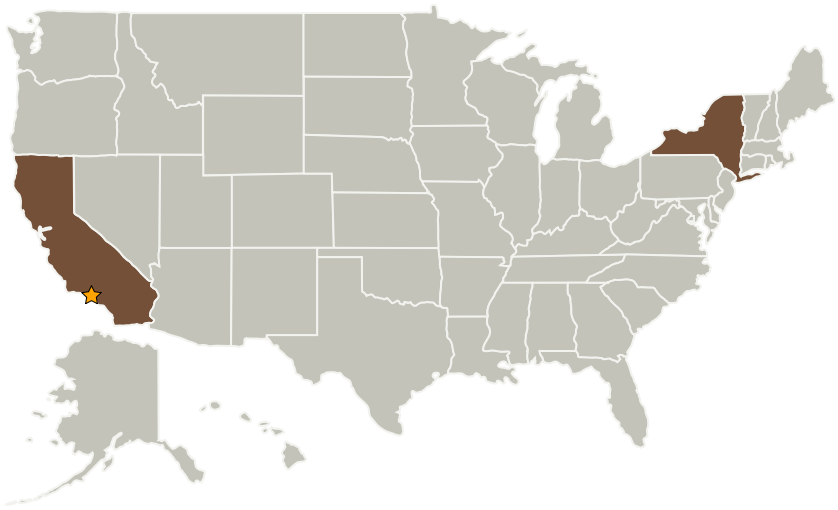
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California
Honeybee Robotics, Ltd.	Supporting Organization	Industry	Pasadena, California

Primary U.S. Work Locations	
California	New York

Project Transitions

January 2009: Project Start

July 2009: Closed out

Closeout Summary: Novel Heat Flow Probe Design and Deployment, Phase I P roject Image

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

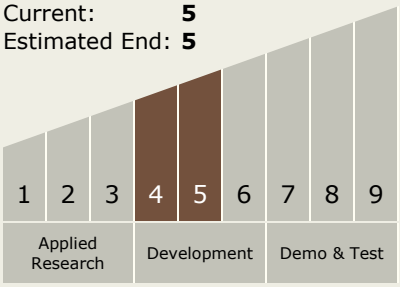
Carlos Torrez

Principal Investigator:

Kris Zacny

Technology Maturity (TRL)

Start: **4**
Current: **5**
Estimated End: **5**



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Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.2 Thermal Control Components and Systems
    - TX14.2.8 Measurement and Control